BRIDGEWATER GROUP, INC.

Source Control Evaluation
Basin 22 Storm Water Sampling and Analysis Plan
Burgard Industrial Park
Portland, Oregon

TO: Jim Orr/Oregon DEQ

CC: Mat Cusma/Schnitzer
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FROM: Ross Rieke/Bridgewater Group

DATE: October 10, 2011

This memorandum presents the Basin 22 Storm Water Sampling and Analysis Plan (Basin 22 SAP) for the Burgard Industrial Park (BIP) Source Control project in Portland, Oregon (Figure 1, Figure 2). A Basin 22 SAP was requested by the Oregon Department of Environmental Quality (DEQ) in an October 1, 2010 letter and further discussed during a November 17, 2010 meeting.

This Basin 22 SAP has been revised from a previous March 25, 2011 Basin 22 SAP based on further assessment of the nature and extent of Basin 22. In particular, review of the storm water system and site drawings noted a second discharge into the proposed sampling manhole. The second discharge is from the building roof drains. The additional assessment also resulted in revision of the western extent of Basin 22.

Basin 22 Description

Basin 22 consists of an approximately 14 acre area in the northwest corner of the BIP. Figure 3 shows the approximate boundaries of Basin 22. The Basin 22 boundaries are estimated from observations of the site during wet weather conditions, the locations of catch basins, storm water system assessments on adjacent properties, storm water plan drawings, and the general topography of the basin. About ½ of Basin 22 is outside the boundaries of the BIP on the Jefferson Smurfit property.

As shown on Figure 3, a series of catch basins drains the northern portion of Basin 22 to a storm water pump station which pumps the storm water into a storm water detention pond. If the water level in the pond nears the top of the pond, water is manually discharged by opening a valve allowing discharge to a manhole located near the southern edge of the BIP. Building roof drains also discharge to the manhole. Discharge from the manhole joins with runoff from the southern portion of Basin 22 (off of the BIP) and is discharged out Outfall 22 to the IT Slip. Based on discussions with the site operator, water has not reached sufficient levels in the pond for discharge to occur, including during heavy rainfall events in January and February of this year.

The southern boundary of Basin 22 is the top of bank along the northern edge of the IT Slip. The narrow strip of land south of this boundary is part of the BIP and consists of the heavily vegetated and/or armored (i.e. predominantly non-erodible) slope of the bank. This slope does not receive any runoff from Basin 22 (or any other portion of the Burgard uplands) and any precipitation falling on this slope infiltrates down through the vegetation and armor, and does not become part of the Basin 22 discharge. The potential for erodible soil from this area is being assessed through separate sampling activities.

The relevant (northern) portion of Basin 22 consists of approximately 8 acres and includes a 72,000 sq. ft. building occupied by two business entities. The western portion of the building is occupied by Wilbur-Ellis Co., operating a dry-bulk (animal feed and organic fertilizer) packaging, ingredient blending, and transloading facility. These activities are predominantly conducted inside the building or under cover. The eastern portion of the building is occupied by RB Recycling, Inc., operating a tire shredding and rubber processing facility. The majority of these operations are conducted inside the building. The areas directly beneath outside processing and conveying equipment is either recycled as process cooling water or is discharged to the sanitary sewer. All operations in this basin occur on paved areas.

Source Control Evaluation Approach

The Basin 22 source control evaluation sampling and analysis will consist of collecting and analyzing representative storm water samples discharging from the BIP portion of Basin 22 to assess what chemicals, if any, are discharging from the property at concentrations that may pose an unacceptable risk to the Willamette River (i.e., Portland Harbor). No storm water is conveyed onto or through the property from other (upgradient) properties, and the property does not include any shoreline where erodible soils could be a potential direct source of contamination to the river.

The results of the Basin 22 storm water and storm water solids sampling will be used to determine if additional Basin 22 source control measures are potentially necessary, what those measures may consist of, and whether additional data gathering is necessary to further assess potential contaminant sources in Basin 22. As previously discussed with DEQ, SSI does not have a right of access to the portion of Basin 22 located on the BIP and cannot control activities and features in Basin 22.

Storm Water and Storm Water Solids Sampling Program

Sampling Locations

Basin 22 storm water and in-line storm water solids samples will be collected from the sampling manhole shown on Figure 3, prior to the storm water commingling with runoff from areas outside of the BIP. Samples will be collected from each of the two pipes discharging into the manhole; the pipe entering from the northwest from the building roof drains (SP-1) and the pipe entering from the northeast from the discharge from the storm water detention pond overflow (SP-2).

Sampling Frequencies and Conditions

Roof Drain Discharge

Up to four storm water samples will be collected over the next 12 months, as weather conditions and discharge events allow, from the roof drain discharge into the sampling manhole (SP1). Samples will be collected by lowering clean sample containers down the manhole to the roof drain discharge pipe.

Each storm water sampling event will be preceded by at least 24 hours with no more than 0.1 inches of precipitation. All of the storm water samples will be collected within the first three hours of discharge. At least two of the storm water samples will be collected within the first 30 minutes of discharge, as practical. Rainfall gauge data from the Port of Portland Terminal 4 rain gauge will be used to document the rainfall event conditions for each sampling event.

Storm Water Pond Overflow Discharge

Storm water pond discharge samples will be collected if, and when, discharge from the pond occurs. Schnitzer will coordinate with the site operator to be alerted as to when water levels in the pond suggest imminent discharge (i.e., near the top of the pond). Samples will be collected by lowering clean sample containers down the manhole and placing at the pond overflow discharge pipe (SP-2) during periods of discharge from the storm water pond.

Up to four storm water samples will be collected of the storm water pond discharge over the next 12 months, as weather conditions and discharge events allow. The sample will be collected at the estimated middle of the discharge period. Given the detention capacity of the storm water detention pond, discharge from the pond may not directly correlate with rainfall events and it may not be practical, nor necessarily meaningful, to collect storm water samples in accordance with typical storm water sampling rain fall conditions. Based on the lack of discharge during extended periods of heavy rainfall, discharge from the pond may not occur over the proposed sampling period (i.e., next 12 months).

Rainfall data from the Port of Portland Terminal 4 rain gauge will be compiled and summarized for the periods between any sampling events (throughout the monitoring period if discharge/sampling does not occur) to document the rainfall conditions corresponding to pond discharge (or lack of thereof).

Duplicate Storm Water Sample

One duplicate storm water sample will be collected over the course of the overall Basin 22 stormwater sample collection program.

Inline Sediment Trap Samples

Inline sediment traps will be used to collect storm water suspended sediments. Inline sediment traps will be installed in both the roof drain discharge pipe (SP-1) and in the storm water pond overflow discharge pipe (SP-2). The sediment traps will be deployed via the existing manholes. Sediment trap SP-1 will be placed a foot or so up the pipe entering the manhole from the northwest. Sediment trap SP-2 will be placed a foot or so up the pipe entering the manhole from the northeast. The sediment traps consist of a stainless steel bracket and a certified phthalate free HDPE bottle that are mounted at key locations within a sewer line. Photographs and drawings of the sediment trap apparatus are shown in Appendix A.

Sediment Trap Sampling Procedures

City of Portland Standard Operating Procedure (SOP) 5.01b, *Sampling Stormwater Solids Using Inline Sediment Traps*, will be followed for sediment trap preparation, deployment, and monthly inspection field checks. All sample filtration and homogenization will be conducted by the analytical laboratory. City of Portland SOP 5.01b is included herein as Appendix B.

Sediment traps (2 traps per location) will be deployed at each sample location for a minimum target period of four months during the wet-weather period. Sediment traps will be inspected monthly. When inspected, if the collection bottle is more than half full of sediments, the bottle will be capped with teflon-lined screw closures, removed from the mounting brackets, packaged and placed on ice in coolers for transport to the laboratory to be archived. A clean empty collection bottle will then be placed in the trap. If the collection bottle is less than one fourth full at the first monthly inspection, options for repositioning or relocating the equipment, adding additional traps to obtain a higher collection rate, or abandonment of the sediment collection efforts will be considered.

Sediments will be collected and archived by the laboratory throughout the 4-month deployment period. At the end of the deployment period, all sediments for each location will be combined and homogenized and sampled for analysis.

Chemical Analysis of Storm Water and Storm Water Solids Samples

As requested by DEQ, Basin 22 storm water and storm water solids samples will be analyzed for the following:

- PCB aroclors
- Phthalates
- Dioxins
- Butyltins
- Aluminum, antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, and zinc
- Polycyclic aromatic hydrocarbons (PAHs)
- Organochlorine pesticides
- Total suspended solids (TSS)
- Total organic carbon (TOC)
- Total Petroleum Hydrocarbons (gasoline, diesel, and heavy oil)

Table 1 shows the specific analytical methods, laboratory containers, holding times, and preservatives to be used for each parameter for the storm water analysis. Table 2 shows the analytical laboratory detection limits for each chemical for the storm water analysis and compares the limits to the JSCS SLVs. As noted on Table 2, the laboratory detection limits are approximately equal to or less than the JSCS SLVs except for chlorinated pesticides and dioxins.

Table 3 shows the specific analytical methods, laboratory containers, holding times, and preservatives to be used for each parameter for the sediment analysis. Table 4 shows the analytical laboratory detection limits for each chemical for the sediment analysis and compares the limits to the JSCS SLVs. As noted on Table 4, the sediment laboratory detection limits are approximately equal to or less than the JSCS sediment SLVs except for chlorinated pesticides and dioxins.

Sampling and Analysis Results Reporting

A data memorandum will be submitted to DEQ within 30 days of receipt of the final analytical laboratory report for each sampling event. The data reports will include tables presenting results of the laboratory analysis and a comparison with JSCS SLVs. Rainfall event data will also be presented between each sampling event.

Please call if you have any questions.

Attachments:

Table 1 – Storm Water Analytical Laboratory Methods, Sample Containers, Holding times, and

Preservation

Table 2 – Storm Water Analytical Laboratory Detection Limits

Table 3 – Sediment Analytical Laboratory Methods, Sample Containers, Holding times, and Preservation

Table 4 – Sediment Analytical Laboratory Detection Limits

Figure 1 – Site Location Map

Figure 2 – Site Plan

Figure 3 - Basin 22 Drainage Area and Proposed Storm Water Sample Location

Appendix A – In-Line Sediment Sampling Apparatus Figures and Photographs

Appendix B – City of Portland SOP 501b Sampling Stormwater Solids Using Inline Sediment Traps

Tables

Table 1
Water Analytical Laboratory Methods, Sample Containers, Holding Times, and Preservation
Basin 22 SCE Sampling Plan

Analytical Parameter	Analytical Method	Container	Holding Time	Preservation
Aluminum Antimony, Arsenic, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Silver, Zinc	EPA 6020	500-ml HDPE bottle	6 months Hg 28-days	HNO_3 pH<2, 4 ±2°C
Tributyltin	KRONE	1-liter amber	7 day extract 40 days analysis	4 ±2°C
PCB aroclors	EPA 8082	1-liter amber	1 year	4 ±2°C
PCB Congeners	EPA 1668A	1-liter amber	1 year	4 ±2°C
Dioxins/furans	EPA 8290	1-liter amber	1 year	4 ±2°C
Phthalates	EPA 8270SIM	1-liter amber	7 day extract 40 days analysis	4 ±2°C
PAHs	EPA 8270SIM	1-liter amber	7 day extract 40 days analysis	4 ±2°C
Organochlorine Pesticides	EPA 8081	1-liter amber	7 day extract 40 days analysis	4 ±2°C
Total Organic Carbon	SM 5310 Mod	250-ml HDPE bottle	28 days	H_2SO_4 pH<2, 4 ±2°C
Total Petroleum Hydrocarbons	NW-TPH Methods	1-liter amber	7 day extract 40 days analysis	4 ±2°C
Total Suspended Solids	SM 2540D	250-ml HDPE bottle	7 days	4 ±2°C

Table 2
Water Analytical Laboratory Detection Limits
Basin 22 SCE Sampling Plan

Chemical	Portland Harbor JSCS SLV	Analytical Laboroatory Detection Limit
PAHs (ug/l)		
2-Methylnaphthalene		0.020
Acenaphthene	0.2	0.010
Acenaphthylene	0.2	0.010
Anthracene		0.010
Benzo(a)anthracene	0.018	0.010
Benzo(a)pyrene	0.018	0.015
Benzo(b)fluoranthene	0.018	0.015
Benzo(g,h,i)perylene	0.2	0.010
Benzo(k)fluoranthene	0.018	0.015
Chrysene	0.018	0.010
Dibenzo(a,h)anthracene	0.018	0.010
Fluoranthene	0.2	0.010
Fluorene	0.2	0.010
Indeno(1,2,3-cd)pyrene	0.018	0.010
Naphthalene	0.2	0.020
Phenanthrene	0.2	0.010
Pyrene	0.2	0.010
Dibenzofuran	3.7	0.010
PCBs (ug/l)		
Aroclor 1016	0.96	0.02
Aroclor 1221	0.034	0.02
Aroclor 1232	0.034	0.02
Aroclor 1242	0.034	0.02
Aroclor 1248	0.034	0.02
Aroclor 1254	0.034	0.02
Aroclor 1260	0.034	0.02
Aroclor 1262		0.02
Aroclor 1268		0.02
PCB Congeners (pg/l)		
Total PCB congeners	64	9 to 53[1]
Phthalates (ug/l)		
Bis(2-ethylhexyl) phthalate	2.2	0.5
Butylbenzyl phthalate	3	0.5
Dibutyl phthalate	3	0.5
Diethyl phthalate	3	0.5
Dimethyl phthalate	3	0.5
Di-n-octyl phthalate	3	0.5
Pesticides (ug/l)		
2,4'-DDD	0.00031	0.01
2,4'-DDE	0.00022	0.01
2,4'-DDT	0.2	0.01
4,4'-DDD	0.00031	0.01
4,4'-DDE	0.00022	0.01
4,4'-DDT	0.00022	0.01
Aldrin	0.00005	0.01
alpha-Endosulfan	0.051	0.01
alpha-Hexachlorocyclohexane	0.0049	0.01
beta-Endosulfan	0.051	0.01
beta-Hexachlorocyclohexane	0.017	0.01
cis-Chlordane	0.00081	0.01
cis-Nonachlor	0.19	0.01
delta-Hexachlorocyclohexane	0.052	0.01
Dieldrin	0.000054	0.01
Endosulfan sulfate	89	0.01

Table 2
Water Analytical Laboratory Detection Limits
Basin 22 SCE Sampling Plan

Chemical	Portland Harbor JSCS SLV	Analytical Laboroatory Detection Limit
Endrin	0.036	0.01
Endrin aldehyde		0.01
Endrin ketone		0.01
gamma-Hexachlorocyclohexane	0.037	0.01
Heptachlor	0.000079	0.01
Heptachlor epoxide	0.000039	0.01
Hexachlorobenzene	0.00029	0.01
Hexachlorobutadiene	0.86	0.01
Hexachloroethane	3.3	0.01
Methoxychlor	0.03	0.01
Mirex		0.01
Oxychlordane	0.19	0.01
Toxaphene	0.0002	0.01
trans-Chlordane	0.00081	0.01
trans-Nonachlor	0.19	0.01
Dioxins (pg/l)		
2,3,7,8-TetraCDD	0.0051	1.3
Total 2,3,7,8-TetraCDD TEQ Eq	0.0051	1.3
Butyltins (ug/l)		
Butyltin ion		0.16
Dibutyltin ion		0.12
Tributyltin ion	0.072	0.076
Tetrabutyltin		
Metals (ug/l)		
Aluminum		4.0
Antimony	6	0.33
Arsenic	0.045	0.020
Cadmium	0.094	0.040
Chromium	100	0.20
Copper	2.7	0.30
Lead	0.54	0.10
Manganese	50	0.33
Mercury	0.77	0.020
Nickel	16	0.30
Silver	0.12	0.10
Zinc	36	1.3
Pertroleum Hydrocarbons (mg/l)		
Gasoline	1	0.1
Diesel	1	0.25
Oil	1	0.5
TSS (mg/l)		5

1 - Individual PCB congener DLs vary from 9 to 53 pg/l with one exception; PCB 118 DL is 72 pg/l.

Table 3
Soil Analytical Laboratory Methods, Sample Containers, Holding Times, and Preservation
Basin 22 SCE Sampling Plan

Analytical Parameter	Analytical Method	Container	Minimum Mass Req'd for Analysis	Holding Time[1]	Preservation
Aluminum Antimony, Arsenic, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Silver, Zinc	EPA 6020	8-oz glass jar	5 grams	6 months 28 days for Hg	4 ±2°C
Tributyltin	KRONE	8-oz glass jar	30 grams	14 days to extract 1 year analysis	4 ±2°C
PCB Aroclors and Congeners	EPA 1668	8-oz glass jar	30 grams	14 days to extract 1 year analysis	4 ±2°C
Dioxins/furans	EPA 8290	8-oz glass jar	30 grams	14 days to extract 1 year analysis	4 ±2°C
Phthalates	EPA 8270SIM	8-oz glass jar	30 grams	14 days to extract 1 year analysis	4 ±2°C
PAHs	EPA 8270SIM	8-oz glass jar	30 grams	14 days to extract 1 year analysis	4 ±2°C
Organochlorine Pesticides	EPA 8081	8-oz glass jar	30 grams	14 days to extract 1 year analysis	4 ±2°C
Total Organic Carbon	PSEP	4-oz glass jar	10 grams	14 days to extract 1 year analysis	4 ±2°C
Total Petroleum Hydrocarbons	NW-TPH Methods	8-oz glass jar	20 grams	14 days to extract 1 year analysis	4 ±2°C

1 - After processing subsamples using filter and homogenizing. See City of Portland SOP 5.01b.

Table 4
Soil Analytical Laboratory Detection Limits
Basin 22 SCE Sampling Plan

Chemical	Portland Harbor JSCS SLV	Analytical Laboroatory Detection Limit Goal
PAHs (ug/kg)		
2-Methylnaphthalene	200	3.3
Acenaphthene	300	3.3
Acenaphthylene	200	3.3
Anthracene	845	3.3
Benzo(a)anthracene	1050	3.3
Benzo(a)pyrene	1450	3.3
Benzo(b)fluoranthene		3.6
Benzo(g,h,i)perylene	300	3.3
Benzo(k)fluoranthene	13000	3.3
Chrysene	1290	3.3
Dibenzo(a,h)anthracene	1300	3.3
Fluoranthene	2230	3.3
Fluorene	536	3.3
Indeno(1,2,3-cd)pyrene	100	3.3
Naphthalene	561	3.3
Phenanthrene	1170	4.4
Pyrene	1520	3.3
PCBs (ug/kg)		
Aroclor 1016	530	5.0
Aroclor 1221		5.0
Aroclor 1232		5.0
Aroclor 1242		5.0
Aroclor 1248	1500	5.0
Aroclor 1254	300	5.0
Aroclor 1260	200	5.0
Aroclor 1262		5.0
Aroclor 1268		5.0
Total Aroclors	0.39	5.0
PCB Congeners (pg/g)		
CL4-PCB-77	52	1.0
CL4-PCB-81	17	1.4
CL5-PCB-105	170	1.9
CL5-PCB-114	170	1.4
CL5-PCB-118	120	1.9
CL5-PCB-123	210	1.7

Table 4
Soil Analytical Laboratory Detection Limits
Basin 22 SCE Sampling Plan

Chemical	Portland Harbor JSCS SLV	Analytical Laboroatory Detection Limit Goal
CL5-PCB-126	0.05	2.0
CL6-PCB-156/157	210	3.9
CL6-PCB-167	210	1.7
CL6-PCB-169	0.21	2.2
CL7-PCB-189	1200	1.4
Total PCB congeners	390	1 to 4[1]
Phthalates (ug/kg)		
Bis(2-ethylhexyl) phthalate	330	33
Butylbenzyl phthalate		33
Dibutyl phthalate		33
Diethyl phthalate	600	33
Dimethyl phthalate		33
Di-n-octyl phthalate	60	33
Pesticides (ug/kg)		
2,4'-DDD	0.33	0.5
2,4'-DDE	0.33	0.5
2,4'-DDT	0.33	0.5
4,4'-DDD	0.33	0.5
4,4'-DDE	0.33	0.5
4,4'-DDT	0.33	0.5
Aldrin	40	0.5
alpha-Endosulfan		0.5
alpha-Hexachlorocyclohexane		0.5
beta-Endosulfan		0.5
beta-Hexachlorocyclohexane		0.5
cis-Chlordane	0.37	0.5
cis-Nonachlor		0.5
delta-Hexachlorocyclohexane	4.99	0.5
Dieldrin	0.0081	0.5
Endosulfan sulfate		0.5
Endrin	207	0.5
Endrin aldehyde		0.5
Endrin ketone		0.5
gamma-Hexachlorocyclohexane		0.5
Heptachlor	10	0.5
Heptachlor epoxide	16	0.5

Table 4
Soil Analytical Laboratory Detection Limits
Basin 22 SCE Sampling Plan

Chemical	Portland Harbor JSCS SLV	Analytical Laboroatory Detection Limit Goal
Hexachlorobenzene	19	0.5
Hexachlorobutadiene	600	0.5
Hexachloroethane		0.5
Methoxychlor		0.5
Mirex		0.5
Oxychlordane		0.5
Toxaphene		15
trans-Chlordane	0.37	0.5
trans-Nonachlor		0.5
Dioxins (pg/g)		
1,2,3,4,6,7,8-HeptaCDD	690	0.12
1,2,3,4,6,7,8-HeptaCDF	690	0.12
1,2,3,4,7,8,9-HeptaCDF	690	0.13
1,2,3,4,7,8-HexaCDD		0.081
1,2,3,4,7,8-HexaCDF	2.7	0.076
1,2,3,6,7,8-HexaCDD		0.073
1,2,3,6,7,8-HexaCDF	2.7	0.073
1,2,3,7,8,9-HexaCDD		0.11
1,2,3,7,8,9-HexaCDF	2.7	0.081
1,2,3,7,8-PentaCDD	2.6	0.15
1,2,3,7,8-PentaCDF	2.6	0.082
2,3,4,6,7,8-HexaCDF	2.7	0.087
2,3,4,7,8-PentaCDF	0.030	0.055
2,3,7,8-TetraCDD	0.0091	0.059
2,3,7,8-TetraCDF	0.77	0.091
OCDF	23000	0.20
OCDD	23000	0.16
Butyltins (ug/kg)		
Butyltin ion		1.4
Dibutyltin ion		3.9
Tributyltin ion	2.3	1.4
Metals (mg/kg)		
Aluminum		5.0
Antimony	64	0.10
Arsenic	7	0.20
Cadmium	1	0.10

Table 4
Soil Analytical Laboratory Detection Limits
Basin 22 SCE Sampling Plan

Chemical	Portland Harbor JSCS SLV	Analytical Laboroatory Detection Limit Goal
Chromium	111	0.10
Copper	149	0.40
Lead	17	0.10
Manganese	1100	0.20
Mercury	0.07	0.030
Nickel	48.6	0.20
Silver	5	1.0
Zinc	459	1.0
Total Petroluem Hydrcarbons (mg/kg)		
Gasoline		4.0
Diesel		20
Oil		40

1 - Individual PCB congener DLs vary from 1 to 4 pg/g.

Figures

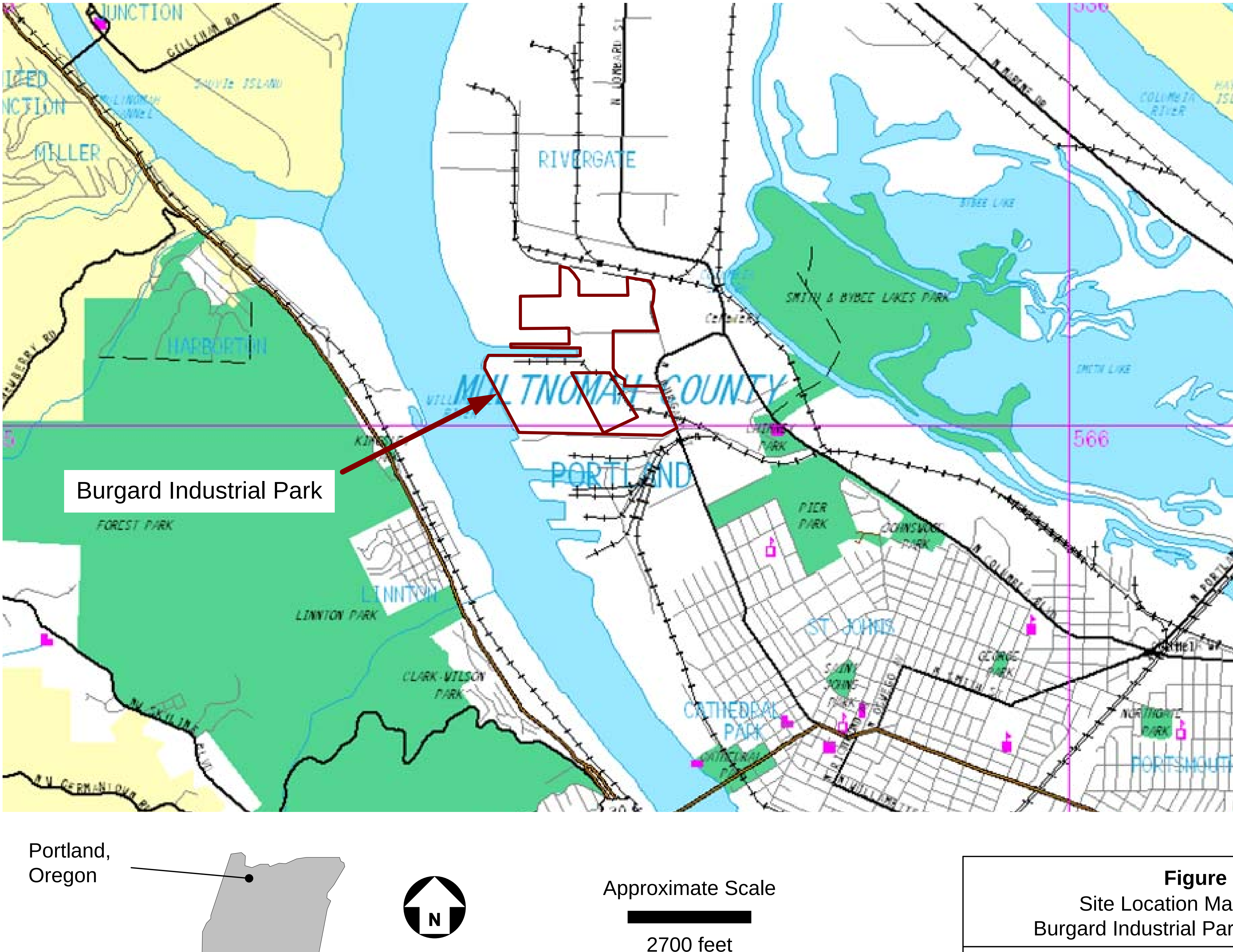


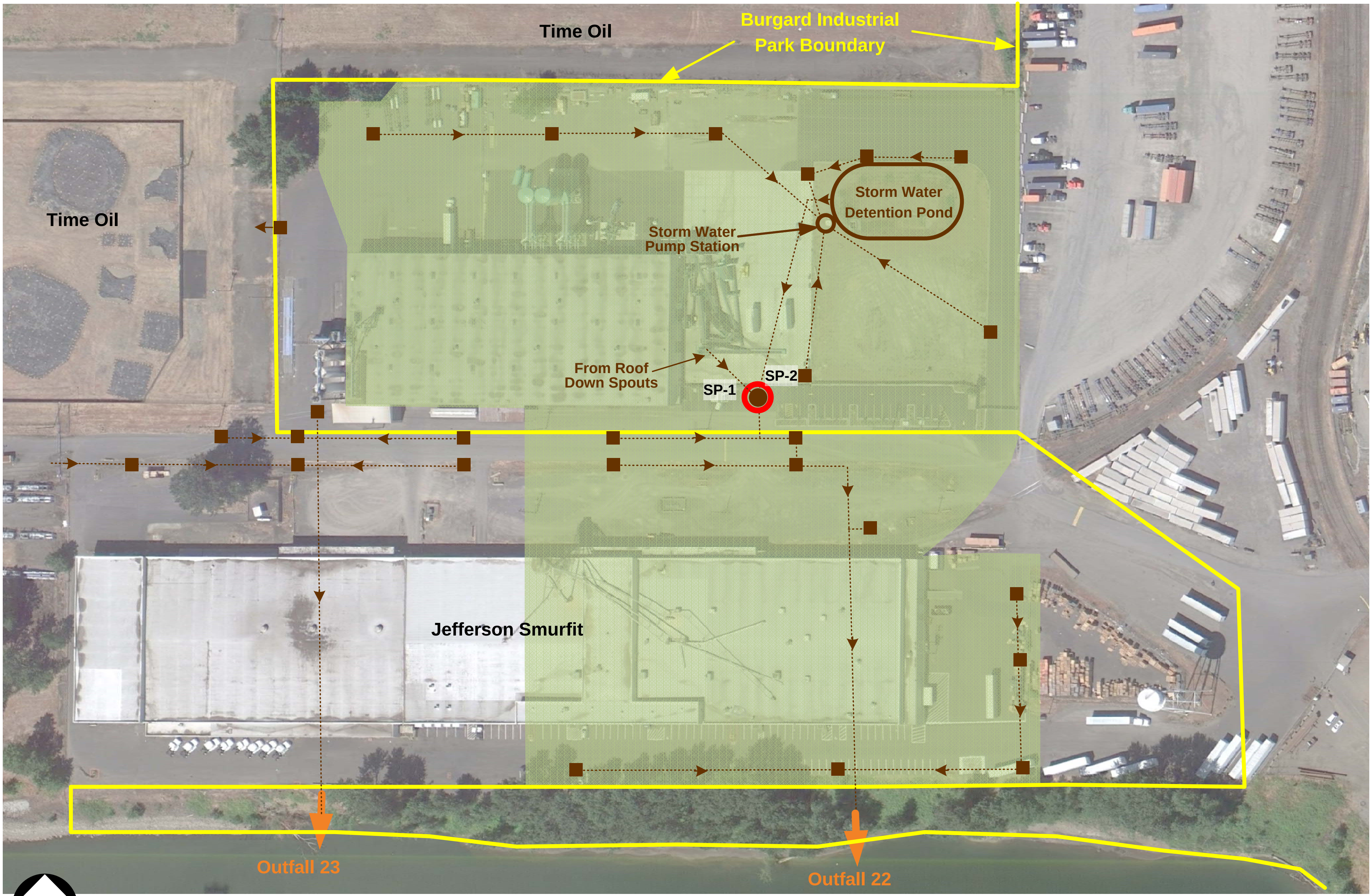
Figure 1
Site Location Map
Burgard Industrial Park

BRIDGEWATER GROUP, INC.

Base Photograph August 2010

Figure 2
Site Plan
Burgard Industrial Park

BRIDGEWATER GROUP, INC.



Approximate Scale

160 feet

Base photograph August 2010

- Catch Basin
- Manhole
- Storm Water Basin 22
- Proposed Storm Water/Solids Sample Location

Figure 3
Basin 22 Drainage Area and Proposed Storm Water Sample Location
Burgard Industrial Park

Bridgewater Group, Inc.

Appendix A - In-Line Sediment Sampling Apparatus Figures and Photographs

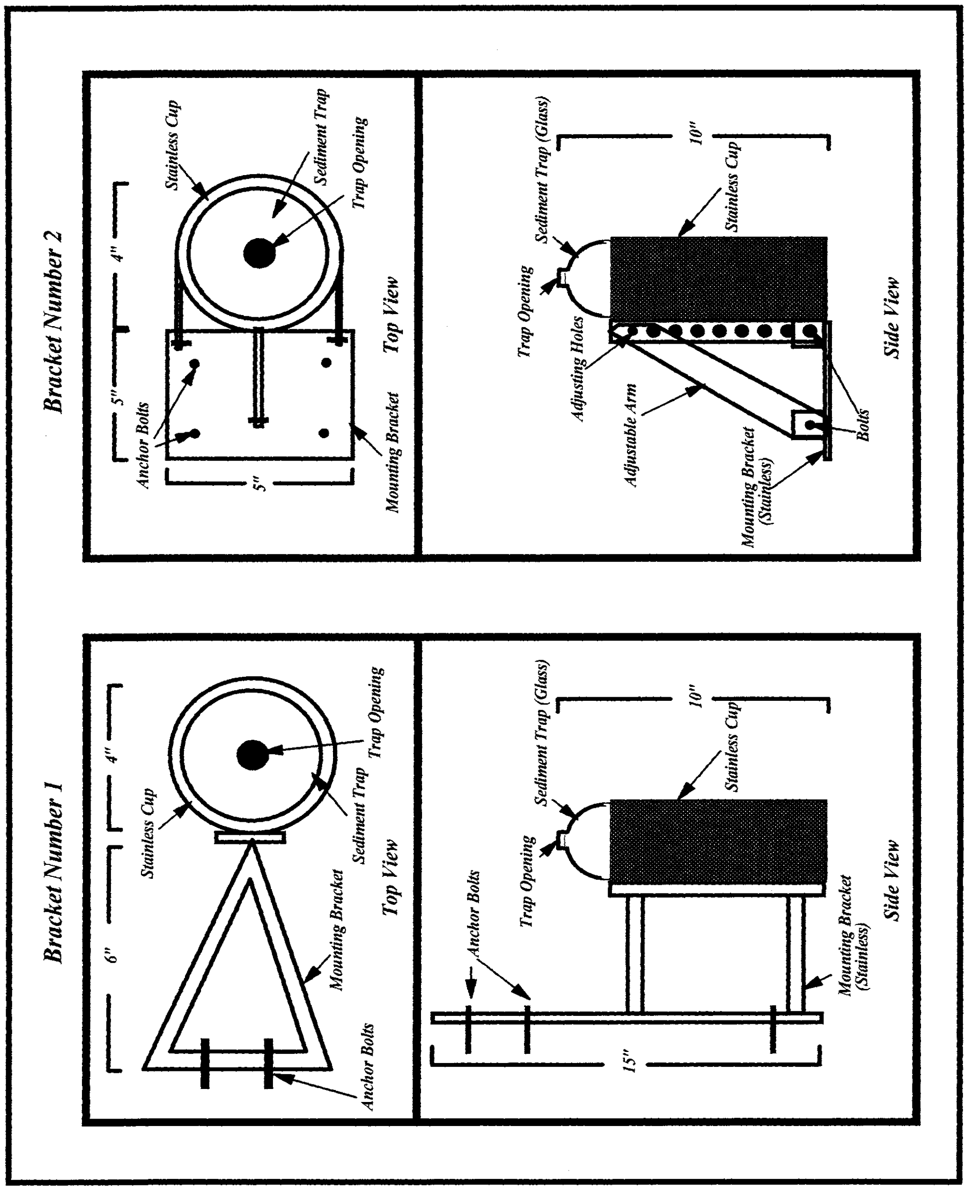


Figure A7: Construction Details of Stormwater Sediment Trap.

Figure 1 (Ecology, 1998)

Photo 1 and 2 (City of Tacoma)

5.2 Supplies for installation and sediment sample retrieval include but are not limited to:

5.2.1 Containers for sediment traps - laboratory cleaned (2 per mount for replacement of a cleaned bottle can occur while at the sampling location at the same time the sample is retrieved and transported to the laboratory for analysis). Teflon containers are recommended for sediment traps, but bottle type is dependent upon parameters to be analyzed.

5.2.2 Hammer drill with ¼" concrete drill bit.

5.2.3 Stainless Steel metal hit anchors.

5.2.4 Hammer.

5.2.5 Latex gloves.

5.2.6 Cooler with ice.

5.2.7 Field notebook.

5.2.8 Sample labels.

5.2.9 Chain-of-custody forms.

5.2.10 Personal Protective Equipment (PPE).

5.2.11 Camera.

5.2.12 Sample jars/containers with preservatives.

5.2.13 Confined space entry equipment (if applicable). (Seattle, 2008)

Appendix B - City of Portland SOP 501b Sampling Stormwater Solids Using Inline Sediment Traps

FIELD OPERATIONS
STANDARD OPERATING PROCEDURE

SAMPLING STORMWATER SOLIDS USING INLINE SEDIMENT TRAPS

1.0 PURPOSE

This Standard Operating Procedure (SOP) details guidelines and procedures for collecting stormwater solids within stormwater collection systems using inline sediment traps.

2.0 SCOPE AND APPLICABILITY

Many contaminants, such as metals and organics, have an affinity for small diameter solids transported by stormwater, which can result in these contaminants accumulating in bottom sediments in receiving waters. Evaluating the source and the concentrations of contaminants within stormwater has proven difficult due to low concentrations of contaminants (specifically organics) in stormwater samples. Analyzing sediment transported by stormwater has proven more successful due to higher concentrations detectable in solids versus water samples. However, capturing sufficient sediment volume for analysis is difficult with most existing stormwater sampling techniques due to the expensive, labor-intensive and challenging nature of coordinating sampling with episodic storm events (Washington State Department of Ecology, 1995 and 1996).

Inline sediment traps are passive, inexpensive, stormwater solids samplers that operate over a relatively long deployment period without maintenance as compared to continuous-flow centrifuges, flow-paced composite stormwater samplers or the collection and filtration of large volume stormwater samples.

Inline sediment traps generally consist of two components: a stainless steel mounting assembly (including a mounting base plate, sample bottle cylinder, collar and arm), and a domed, narrow-mouth sample bottle. Stormwater solids are captured by the sediment trap through fluid exchange of particle-laden flow over the downstream edge of the sediment trap bottle, causing particles to settle out into the trap.

Sediment traps are located at key points within the stormwater collection system to identify sources of contaminants found in stormwater or receiving water sediments. Specific monitoring locations are selected based on project objectives and pre-determined prior to trap installation.

This SOP details methods used for sediment trap installation, routine monitoring and subsequent sediment extraction/processing. This procedure is applicable for the collection of suspended stormwater solids using inline sediment traps, typically in high-energy storm sewers and catch basins within stormwater collection systems.

3.0 EQUIPMENT AND MATERIALS

The following is a list of required equipment for the installation, monthly field checks and extraction/processing of stormwater solids using inline sediment traps.

3.1 Inline Sediment Trap Installations and Monthly Field Check Equipment

Project Work Order
Chain-of-Custody (COC)
Inline Sediment Trap Field Data Sheets
Confined Space Entry Permit
Job Safety Analysis (JSA) form
Stainless steel sediment trap mounting assembly
3/8-inch (in) stainless steel wedge anchor bolts
1-liter (L) high density polyethylene (HDPE) sample bottle(s) with polytetrafluoroethylene (PTFE) lined lids (bottles must be “Certified Clean” and certified phthalate-free)
Nitrile gloves
Ruler accurate to 0.1 inches (in)
1-gallon (gal) Ziploc® freezer bags
Permanent marker
Cooler w/foam dividers and chilled blue ice
5-gal polycarbonate carboy w/ultra-pure deionized water (UPDI)
Confined space entry vehicle equipped with: traffic control equipment and confined space entry gear (atmosphere monitor, tripod, fall block, harnesses, waders, rain coats, hard hat, head lamp, safety goggles, etc.)
Kneepads
Tools, including: rotohammer, hammer, socket wrenches, etc.
Digital camera
Cell phone

3.2 Inline Sediment Trap Extraction and Sample Processing Equipment

Chain-of-Custody (COC)
Inline Sediment Trap Field Data Sheets
Inline Sediment Trap Sample Processing Data Sheets
90-millimeter (mm) stainless steel filter support w/glass microfiltration assembly
110-millimeter (mm) qualitative cellulose filters [2-5-micrometer (μm) filter paper]
Peristaltic pump and tubing
1200-milliliter (mL) stainless steel beaker
Stainless steel tweezers, funnel, spatula and/or scoopulas
1-liter (L) glass, heavy-walled, side-arm Erlenmeyer flask
PTFE squirt bottle
Versi-Dry®-lab soaker paper
8-ounce (oz) amber, wide-mouth sediment jars
Ultra-pure deionized water (UPDI)

4.0 PROCEDURE

Below are standard operating procedures to be followed when using inline sediment traps to collect suspended stormwater solids.

4.1 Clean Sample Collection and Processing Techniques

The "clean hands – dirty hands" sampling method [Environmental Protection Agency (EPA) 1996] is an often-referenced method for the collection of environmental samples for low level analyses, most commonly used for trace metals work. However, it has been found that when working in the rain or other inclement weather and/or in confined spaces it is not always possible to fully implement this method. Under this SOP, field teams will follow clean sample collection and processing techniques to the extent practical to minimize the potential for introducing contamination to the sediment traps and/or the stormwater solids samples. Procedures below present a flexible sampling philosophy designed to ensure that the highest quality data be collected consistent with EPA clean sampling guidelines.

1. Sampling teams will prevent contamination of any of the following items: stainless steel mounting assembly and hardware, sample bottles, lids, and sample media by frequently changing gloves, usually with each change of task (wearing multiple pairs of gloves will allow field personnel to rapidly change gloves during each task). Phthalate-free gloves will be used for any location where phthalates will be sampled.
2. Sampling teams will remove and place PTFE-lined bottle lids into a clean Ziploc® bag after the sample bottles are secured in the sediment trap hardware.
3. At the time of bottle removal, sampling teams will re-cap sample bottles using clean PTFE-lined lids stored in a sealed, clean Ziploc® bag, prior to removing sample containers from sediment traps.
4. Capped sample bottles will be double-bagged in clean Ziploc® bags. Packaged sample bottles will be placed into a cooler with chilled blue ice for transport back to the City of Portland, Water Pollution Control Laboratory (WPCL).
5. Whenever possible, sediment traps should be installed and accessed upstream and upwind of sampling personnel to minimize contamination potential.

All sample processing will be done in a laboratory environment using clean sample handling and processing techniques to maintain sample integrity throughout the processing event.

4.2 Sediment Trap Deployment

Inline sediment traps will be installed in open-channel, storm sewers or catch basins. Field personnel will review the project-specific *Work Order* to determine specific project requirements including project objectives, proposed monitoring locations and deployment periods. A typical deployment period can be several months, an entire wet-weather period (e.g., October to May) or as determined appropriate for each specific project.

4.2.1 Sediment trap equipment preparation

All sediment trap mounting hardware will be cleaned using a scrub brush and a non-phosphate, lab-grade detergent, rinsed with tap water and allowed to air-dry prior to installation. Field Operations (FO) personnel will wear clean phthalate-free gloves during the pre-installation cleaning. This pre-installation cleaning requirement is not intended to decontaminate the sediment trap mounting hardware, as it will not be directly contacting the sample; rather, it is intended to remove any manufacturing residue and reduce the potential for sample contamination.

HDPE sediment trap bottles with PTFE-lined lids will be obtained certified clean and phthalate free from a laboratory or bottle supplier. Certificate of Analysis for the certified clean sediment trap bottles will be kept on file for all sediment trap projects. Bottle blanks should be collected when using a new type or brand of bottles, or when detection limits on the Certificate of Analysis are not sufficiently low enough for project objectives. Refer *to SOP 7.01C - QC Sample Collection* for bottle blank collection procedures.

4.2.2 Traffic control/site safety

The first field crew to visit a sediment trap monitoring location will fill out a *Job Safety Analysis (JSA)* form. The *JSA* form will describe any real or potential hazards at the location. Field personnel will also document traffic control and access concerns at sediment trap monitoring location on the *Inline Sediment Trap Field Data Sheets*. For each subsequent site visit, the field crew shall set up traffic control, if needed, and observe safety instructions contained in detail on the *JSA* form included in the project file. The *JSA* form should be updated as needed to reflect any changes that occur at the site.

4.2.3 Confined space entry

Installation, and monthly field checks of a sediment trap at a location that is a permit-required confined space should be conducted ONLY by trained individuals who are certified by the City of Portland to enter confined spaces. Such an entry into a permit required confined space should be performed in accordance with City of Portland, *BES Confined Space Entry Policy and Procedures Manual*.

4.2.4 Sediment trap installation

Field personnel will access the monitoring locations as specified in the *Work Order*. Once the traffic control and the confined space entry permit have been completed, field personnel can install the inline sediment traps.

Two independent sediment traps are typically used at each monitoring location to ensure enough solids are captured. The volume and solids concentration in the stormwater flow may make it difficult to obtain sufficient sediment sample volume using only two sediment traps. If it appears that insufficient stormwater solids will be collected at a site (due to low storm flows, small diameter storm pipes, or shorter deployment periods) additional sediment traps should be installed.

1. Field personnel verify site address, node location and number.
2. Entrant enters manhole or monitoring location in confined space entry gear, wearing multiple pairs of phthalate-free gloves. Entrant assesses storm sewer pipe or catch basin and collects location information detailed on the *Inline Sediment Trap Field Data Sheets* (e.g., water depth, pipe diameter, flow conditions, presence of sediment, etc.) and determines most representative location to install sediment traps based on proposed general location detailed in *Work Order*. Due to physical constraints (e.g., laterals or other obstructions), proximity to catch basins and pipes too small to work in; it may be necessary for entrants to install the sediment traps at locations different from those pre-determined and listed in the *Work Order*. The project manager should be consulted on any significant deviations from the proposed monitoring locations listed in the *Work Order*.
3. Entrant sheds dirty gloves for clean gloves. Attendant records sediment trap location and fills out *Inline Sediment Trap Field Data Sheet*. Attendant dons new, clean gloves, and lowers sediment trap components and tools down to entrant.
4. Entrant installs sediment traps by bolting the stainless steel base plate directly to the pipe bottom or catch basin walls using a rotohammer, hammer, wrenches and stainless steel anchor bolts. After drilling is

completed and anchor bolts are set, the work site will be scrubbed with a brush to remove any debris and rinsed with deionized water before proceeding with trap installation.

5. Sediment trap is assembled (e.g., sample bottle cylinder, collar and arms connected with stainless steel bolts, nuts and washers). Entrant sheds dirty gloves for new, clean gloves.
6. Attendant labels sediment trap bottles with unique location code and bottle ID and lowers sediment trap bottles to entrant.
7. Entrant installs the sediment trap bottles in the stainless steel cylinders and secures sediment trap bottles with sediment trap collar. Trap assembly hardware are tightened. Entrant sheds dirty gloves for new, clean gloves and removes PTFE-lined lids from sediment trap bottles. Lids are placed into a clean Ziploc® bag for subsequent monthly field checks and sediment trap bottle removal. Entrant exits manhole or monitoring location.

4.3 Monthly Field Checks

Sediment traps will be inspected on a monthly basis. The purpose of the monthly field check is to: determine that the trap assembly is still intact and structurally sound, that the trap is not causing a flow impediment to the collection system and to ensure that bottles are not being overfilled with sediment.

Field personnel will enter monitoring locations using confined space entry safety procedures in permit-required confined spaces and follow *JSA* safety instructions. Sampling teams will adhere to clean sample collection and processing techniques when performing monthly field checks and/or when collecting samples from sediment traps.

After accessing the traps, each bottle is removed from the trap and inspected to determine the volume of sediment retained. All observations and activities during the monthly field checks are recorded on the *Inline Sediment Trap Field Data Sheets.* If the sample bottles are less than half full of solids, the bottles are re-secured in the trap. If the sample bottles are more than half full of solids, the bottles will be capped with a clean PTFE-lined lid, double-bagged and placed into a cooler with chilled blue ice for transport to the WPCL. If a sediment trap bottle is removed, a clean, empty bottle will be secured in the trap. The PTFE-lined lid will be removed from the new empty collection bottle and then placed into a clean Ziploc® bag for storage.

Samples will be collected and archived throughout the deployment period when the sediment trap collection bottle(s) are more than half full of solids. Field teams will maintain sample integrity by returning to the WPCL with samples in sealed coolers with chilled blue ice. Upon return to the WPCL, the removed sample bottles will be archived as-is (i.e., without immediate filtering or processing). The bottles will be archived in a secured laboratory refrigerator and secured with signed and dated chain-of-custody labels until the completion of the deployment period. Once the deployment period has ended, all sampled solids (including archived aliquots) will be processed and homogenized for analyses.

4.4 Sediment Trap Removal

All sediment traps will be removed at the end of a project deployment period. Bottles will be inspected and removed using procedures discussed in *Section 4.3*. All removal activities will be documented on the *Inline Sediment Trap Field Data Sheets.* Removed sediment trap assemblies will be taken back to WPCL and cleaned using a scrub brush and a non-phosphate, lab-grade detergent, rinsed with tap water and allowed to air-dry prior to storage.

4.5 Sediment Extraction and Sample Processing

At the completion of the deployment period, all sampled solids (including solids from samples removed and archived from interim monthly visits) will be extracted and processed by FO personnel in the WPCL Field Lab. Solids are separated from the stormwater in the laboratory using a microfiltration assembly consisting of a glass funnel, 2-5 μm cellulose filters and a filter support w/glass stem connected to a side-arm Erlenmeyer flask. Negative pressure created by a peristaltic pump connected to the flask accelerates the filtration process.

All sediment extraction and sample processing equipment will be decontaminated in accordance with *SOP 7.01a - Decontamination of Sampling Equipment*. FO personnel will ensure that clean sample handling and processing techniques are maintained during the extraction and sample processing of all inline sediment trap samples.

4.5.1 Filtration assembly

Prior to sample extraction and processing, sampling technicians will need to complete the following steps and procedures:

1. Wear clean phthalate-free gloves while assembling the clean filtration assembly.
2. Set up the decontaminated 90-mm stainless steel filter support w/glass stemmed, conical funnel, microfiltration assembly on a clean surface (lab cart with Versi-Dry®-lab soaker paper).
3. Connect peristaltic silicone tubing (rinsed with UPDI) to the decontaminated 1-L glass, heavy-walled, side-arm Erlenmeyer flask.
4. Connect the side-arm flask to the 90-mm stainless steel filter support w/glass stem through a No. 8 silicone stopper. The side-arm flask will only be used to capture filtrate during the sample processing and should not come into contact with the filtered sediment.
5. Connect the other end of the peristaltic tubing to a peristaltic pump to create a negative pressure vacuum for filtering the samples. Both the filtration assembly and the peristaltic pump tubing section will be affixed to a lab stand for stability.
6. Squirt a small quantity of UPDI from a PTFE-squirt bottle onto the 90-mm stainless steel filter support, which nests in the glass stemmed support base.
7. Carefully place a clean 2-5 μm, 110-mm qualitative cellulose filter onto the pre-wetted 90-mm stainless steel filter support using decontaminated stainless steel tweezers, while wearing phthalate-free gloves.
8. Smooth out the edges of the filter with the decontaminated stainless steel tweezers to create a tight seal.
9. Place the decontaminated 1000-mL glass conical funnel onto the 90-mm stainless steel filter support, being careful not to tear the filter, and secure the aluminum clamp to the filtration assembly. Place clean tweezers onto clean foil for subsequent filter paper applications.
10. Turn on the peristaltic pump and ensure that a vacuum tight seal has occurred prior to sample processing.

4.5.2 Sample filtration

During sample filtration, sampling technicians will document all filtration activities on the *Inline Sediment Trap Sample Processing Data Sheet*. Sampling technicians will need to follow the following procedures when filtering sediment trap samples:

1. Slowly pour the water in small aliquot amounts from each sample bottle into the filtration assembly while the peristaltic pump runs. Do not exceed a total liquid depth of ~1-inches in the conical funnel. As the flow through rate almost ceases, stop adding aliquots, and allow remaining sample to be filtered.

2. After all free water has been filtered from the poured aliquot then turn off the peristaltic pump, remove and place clamp and 1000-mL glass conical funnel onto a clean section of foil.
3. Tare an 8-oz amber wide-mouth sediment jar with lid on an electronic scale.
4. Label the sample jar with the proper point code and tare weight with lid on in grams (g) to nearest 0.1g. Gently scrape any visible sediment off of the filter using a decontaminated spatula. Place the scrapped filtered sediment into the sample jar and place the spatula onto a clean piece of foil. Remove the used filter and repeat *Steps 6-10*, from *Section 4.5.1*, until most of the water is decanted from the sample bottle.
5. Once most of the water is decanted, swirl the remaining water to mobilize the remaining sediments in the bottom of the sample bottle. Slowly pour the remaining slurry into the filtration assembly in 0.5-inch aliquot depth being careful not to clog the filter with large aliquot volumes.
6. Filtering the last of the sediments in the sample bottle can be challenging and may take several attempts and/or filters. To ensure all sediment adhering to sample bottle is mobilized and captured, when no more free water exists in sample bottle; pour 100-mL aliquots of UPDI from a decontaminated stainless steel beaker into the sample bottle. Cap, shake, and filter UPDI slurry using previous filtration methods.
7. Repeat *Step 6* until no sediments are visible in the sample bottle.
8. Scrape the last of the filtered sediment from the filter and place into the 8-oz sample jar.

Note: The water content of the sediment trap samples is not a critical parameter, because the sediment trap does not represent any ambient condition in terms of water content. Any water extracted from the trap or UPDI added is considered inconsequential to the objectives of this SOP.

Record the number of filters used, number of UPDI rinses, total estimated volume of UPDI and dewatered/filtered sediment weight on the *Inline Sediment Trap Sample Processing Data Sheet* for each sample bottle processed. Repeat all procedures from *Section 4.5* for all archived sample bottles for each monitoring location. All the sediment for each specific monitoring location will typically fit in one 8-oz sample jar. If sediment volume exceeds one 8-oz jar refer to *Section 4.5.3*.

4.5.3 Sediment sample homogenization and compositing

Once all sample bottles, including any archived bottles, are processed from one sediment trap monitoring location, homogenize the filtered sediment in the 8-oz sample jar, by thoroughly mixing using a clean decontaminated stainless steel implement. If filtered sediment volume for a single monitoring location exceeds 8-oz, processed sediment should be homogenized and composited in a decontaminated stainless steel bowl.
Use a stainless steel spoon to homogenize the collected sediment by thoroughly mixing the material in the bowl and transfer into multiple amber, wide-mouth sample containers.

4.5.4 Relinquishing samples

Filtered sediment samples will be relinquished under chain-of-custody protocols per *SOP 7.01d - Sample Chain-of-Custody*. For cross-referencing purposes, sample ID stickers will be affixed on all documents, including the *Inline Sediment Trap Sample Processing Data Sheets* and *COC*.

If sediment volume is insufficient to run all the requested laboratory analyses, laboratory staff should consult the *Work Order* for a prioritized list of analyses.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

To ensure that decon procedures are adequate and that bottles arrive clean from a laboratory or bottle supplier, blank water samples will be generated to test the cleaning procedures on the filtration assembly and the sample bottles.

Each storage freezer unit at the WPCL is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

6.0 RESOURCES

(1) *EPA Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels,* U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division, Washington, D.C., 1996.

(2) Washington State Department of Ecology, 1995. Stormwater Sediment Trap Literature Review and Design Consideration. Ecology Report No. 95-309, Olympia, Washington. February.

(3) Washington State Department of Ecology, 1996. Stormwater Sediment Trap Pilot Study. Publication No. 96-347, Olympia, Washington. November.